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ABSTRACT

A study investigated the effect of writing in statistics classes on students' interpretation skills (translating the results of data analysis into verbal interpretations that are accessible to non-statisticians). One hundred twenty-two students in three statistics classes received either low, moderate, or high instructional emphasis in interpretive skills. Results indicated that students in the high emphasis class who wrote "press releases" (based on the data sets) that were free of statistical jargon achieved higher scores on computation and interpretation, relative to scores received by students in either the moderate or low emphasis class. Results also showed no differences in level of conceptual knowledge across classes, indicating that a high emphasis on interpretation did not detract from student focus on concepts. Results further indicated that writing focused students' attention on the context and rationale for statistics. (One figure of data is included.) (PRA)

Writing in Statistics Classes Encourages Students to Learn Interpretation

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Students in three statistics classes received either traditional, moderate, or extensive instructional emphasis in interpretive skills. Students in the extensive emphasis class who wrote "press releases" free of statistical jargon achieved higher scores on computation and interpretation, but not on conceptual knowledge relative to either a moderate or traditional emphasis class. Writing focuses students' attention on the context and rationale for statistics. This approach may have broader application for other, more content-oriented courses.

Writing in Statistics Classes
Encourages Students to Learn Interpretation

Writing in the curriculum has received considerable attention recently, including an entire issue of Teaching of Psychology (Nodine, 1990), although statistics does not seem to be included in such discussions. In this abstract, I outline a writing program in statistics designed to encourage development both of writing and of interpretive skills. As Dillbeck (1982) notes, teachers should present statistics in terms that make sense to students; at the same time, the circle is completed as students learn to translate the results of data analysis into verbal interpretations that are accessible to non-statisticians.

The impetus for this project arose with my recognition that students in my statistics classes developed proficiency in computation but were unable to express meaningful verbal interpretations of the data. That is, they could adequately formulate null and alternate hypotheses symbolically (e.g., using mu or rho), but their verbal statements only reiterated rejection or failure to reject the null hypothesis. To remedy this deficit, I instituted the option of allowing students to write extra credit "press releases" based on data sets either given to them in class or made available to them on their computer accounts.

My hope was that practice in interpretation and discussion would augment their interpretive skills beyond the level reached in those classes in which I merely repeated the instructions that students should interpret their results. I also entertained the unwanted possibility that students might overemphasize the verbal

components of statistics to the exclusion of concepts and computations; if this occurred, their conceptual and computational abilities, as reflected in test scores, would diminish. Thus, over four semesters, I systematically monitored student performance in different classes with respect to computational skills, interpretive abilities and conceptual knowledge.

Method

Subjects

A total of 122 students over four semesters provided data for this study.

Materials

Student final exam scores in my statistics classes constituted the data. Each final exam had three components: a computational, open-book part; a closed-book, conceptual segment; and an interpretive phase involving verbal discussion of the results of statistical analysis. For one class, students also had extra credit writing assignments, the interpretations of which were discussed extensively in class for the benefit of students who may not have chosen to complete these five assignments. The writing assignments were taken from a variety of sources like the Information Please Almanac (1987) and The Great American Baseball Stat Book (James, Dewan & Project Scoresheet, 1987).

Structure of the classes

Class 1. Students were encouraged to provide coherent verbal interpretations of quiz and homework problems. There was no explicit training in the development of this skill. With respect to interpretation, this is the Low Emphasis Group.

Class 2. We spend class time developing explanations and interpretations of quiz and homework problems. This increased emphasis on interpretation was consistent throughout the entire course. this is the Moderate Emphasis Class.

Class 3. In addition to the interpretive skills fostered in the second class, students had the option to complete writing assignments, "press releases," based on the data. These assignments were expected to be about a typewritten page in length. They were to be free of statistics jargon and accessible to a reader with no particular statistical knowledge. This is the High Emphasis Class.

Class 4. Due to scheduling problems, the writing assignments in the High Emphasis Group were omitted, making this class quite similar to Class 2, the first Moderate Emphasis Group.

Procedure. Student scores on the final exam were recorded for segments dealing with concepts, computations and interpretation. The patterns of performance corresponding to type of emphasis were analyzed using orthogonal polynomials subsequent to an omnibus F-test.

Results

Computational scores

The only significant difference among classes with respect to computations involved Class 2 (Moderate Emphasis) and Class 3 (High Emphasis), $F(3,118) = 3.43$, $p = .0194$. An analysis of trend, however, showed a significant cubic trend, $F(1,118) = 7.24$, $p = .0082$. This pattern revealed nearly identical, lower scores for the low and moderate emphasis classes, with a striking increase for

the high emphasis class. The results are depicted in Figure 1.

Interpretation scores

The High Emphasis class generally showed higher scores on verbal interpretation than the other classes; it differed from the Low Emphasis class and one Moderate Emphasis class. An analysis of trend revealed significant linear [$F(1,118) = 9.08$, $p = .0032$] and quadratic [$F(1,118) = 16.00$, $p = .0001$] terms. The linear trend reflects the effect of the increase in scores for the first 3 classes even though the scores decreased for Class 4; the quadratic trend signals the decrease in scores for Class 4. The pattern can be seen in Figure 1.

Conceptual scores

There were no differences in level of conceptual knowledge across classes, $F < 1$. Thus, the emphasis on interpretation seems not to have detracted from student focus on concepts.

Discussion

Writing assignments seem to encourage development of interpretive skills and perhaps even help with computations. As the emphasis on interpretation changed, student scores underwent predictable changes. A similar pattern emerged in the analysis of trend for computations, although the amelioration seemed limited to the class with High Emphasis on interpretation. This increase did not come at the expense of conceptual knowledge.

One speculation concerning the increase in computational skills with greatest focus on interpretation is that students may have learned the reason for doing statistics and may have seen the need to attend to the computations. It appears that, without

specific training, students have difficulty understanding the purpose of statistics and, consequently, their abilities to discuss their results suffer.

They need to be told directly that statistics is a tool that allows them to answer questions, not an end in itself. The writing assignments allow them to comprehend the reason for doing statistics while helping them communicate their findings in non-statistics terms. This practice of having students translate statistical results into everyday language has potential application to other classes. Students may begin to understand the meaning and importance of research results by trying to describe them in non-technical language.

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Fig. 1. Final exam scores of statistics students in four classes with different emphasis on interpretation skills. Test components include open-book, computational problems; interpretation skills; and closed-book, conceptual knowledge.